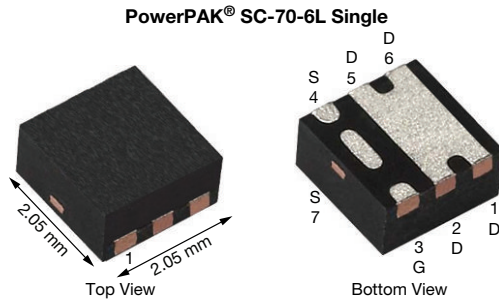


## N-Channel 20 V (D-S) MOSFET



Marking code: A6

PRODUCT SUMMARY	
$V_{DS}$ (V)	20
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 10$ V	0.0047
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.0059
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 2.5$ V	0.0162
$Q_g$ typ. (nC)	10.2
$I_D$ (A) <sup>a</sup>	52
Configuration	Single

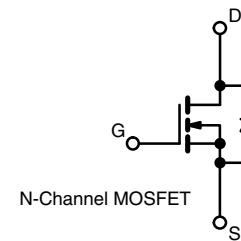
### FEATURES

- TrenchFET<sup>®</sup> Gen IV power MOSFET
- Very low  $R_{DS(on)}$  and excellent  $R_{DS} \times Q_g$  Figure-of-Merit (FOM) in an ultra compact package footprint
- Compact and thermally enhanced package
- Provides exceptional versatility for power management design
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**

### APPLICATIONS

- Synchronous rectification
- Half-bridge power stage
- DC/DC converters
- Battery management
- Load switch



ORDERING INFORMATION	
Package	PowerPAK SC-70
Lead (Pb)-free and halogen-free	SiAA02DJ-T1-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		$V_{DS}$	20	V
Gate-source voltage		$V_{GS}$	+12 / -8	
Continuous drain current ( $T_J = 150$ °C)	$T_C = 25$ °C	$I_D$	52	A
	$T_C = 70$ °C		42	
	$T_A = 25$ °C		22 <sup>b, c</sup>	
	$T_A = 70$ °C		18 <sup>b, c</sup>	
Pulsed drain current		$I_{DM}$	100	
Continuous source-drain diode current	$T_C = 25$ °C	$I_S$	16	
	$T_A = 25$ °C		2.9 <sup>b, c</sup>	
Maximum power dissipation	$T_C = 25$ °C	$P_D$	19	W
	$T_C = 70$ °C		12	
	$T_A = 25$ °C		3.5 <sup>b, c</sup>	
	$T_A = 70$ °C		2.2 <sup>b, c</sup>	
Operating junction and storage temperature range		$T_J, T_{stg}$	-55 to +150	°C
Soldering recommendations (peak temperature) <sup>d, e</sup>			260	

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>b, f</sup>	$t \leq 5$ s	$R_{thJA}$	28	36	°C/W
Maximum junction-to-case (drain)	Steady state	$R_{thJC}$	5.3	6.5	

#### Notes

- $T_C = 25$  °C
- Surface mounted on 1" x 1" FR4 board
- $t = 5$  s
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The PowerPAK SC-70 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components
- Maximum under steady state conditions is 80 °C/W



SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	20	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA	-	14	-	mV/°C
V <sub>GS(th)</sub> temperature coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>		-	3.4	-	
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	0.6	-	1.6	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = +12 V / -8 V	-	-	± 100	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	-	-	10	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 V	10	-	-	A
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 8 A	-	0.0035	0.0047	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5 A	-	0.0044	0.0059	
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 3 A	-	0.0110	0.0162	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 20 A	-	80	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	1250	-	pF
Output capacitance	C <sub>oss</sub>		-	505	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	75	-	
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A	-	22	33	nC
		V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A	-	10.2	16	
Gate-source charge	Q <sub>gs</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A	-	3.2	-	nC
Gate-drain charge	Q <sub>gd</sub>		-	2.6	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz	0.2	1.2	2.4	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 1 Ω I <sub>D</sub> ≅ 5 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω	-	15	30	ns
Rise time	t <sub>r</sub>		-	24	50	
Turn-off delay time	t <sub>d(off)</sub>		-	22	45	
Fall time	t <sub>f</sub>		-	7	15	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 1 Ω I <sub>D</sub> ≅ 5 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω	-	8	20	ns
Rise time	t <sub>r</sub>		-	5	10	
Turn-off delay time	t <sub>d(off)</sub>		-	21	40	
Fall time	t <sub>f</sub>		-	5	10	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	-	-	16	A
Pulse diode forward current	I <sub>SM</sub>		-	-	100	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 0 V	-	0.76	1.2	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 5 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	20	40	ns
Body diode reverse recovery charge	Q <sub>rr</sub>		-	7	15	nC
Reverse recovery fall time	t <sub>a</sub>		-	10	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	10	-	

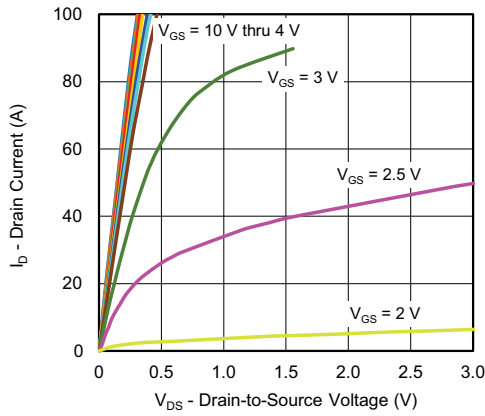
**Notes**

- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %
- b. Guaranteed by design, not subject to production testing

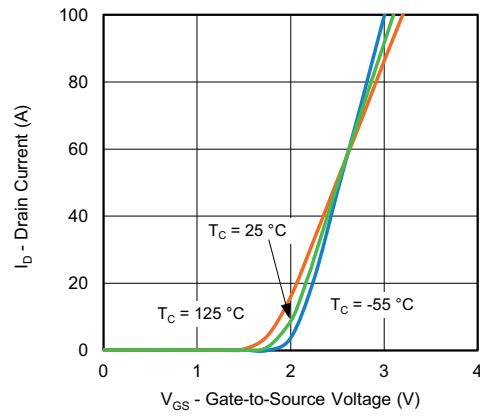
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



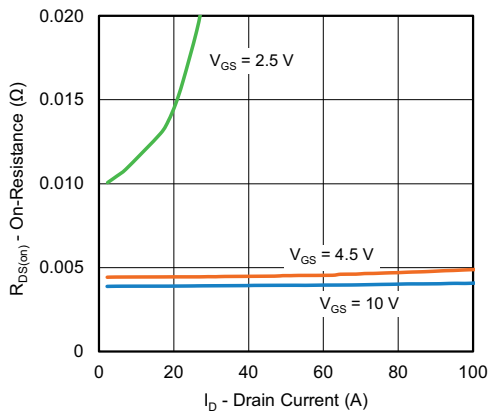
TYPICAL CHARACTERISTICS (T<sub>J</sub> = 25 °C, unless otherwise noted)



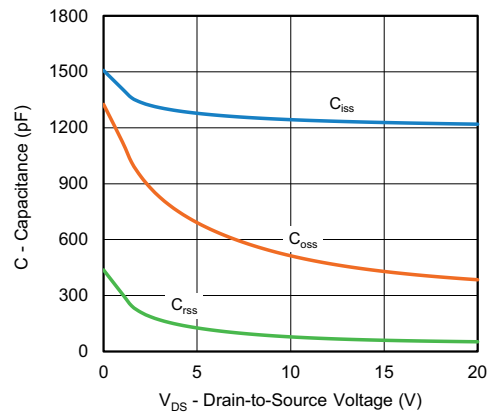
Output Characteristics



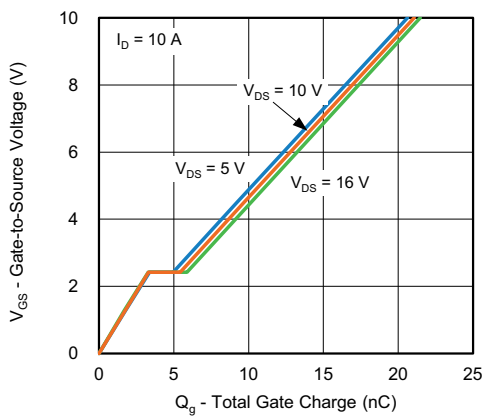
Transfer Characteristics



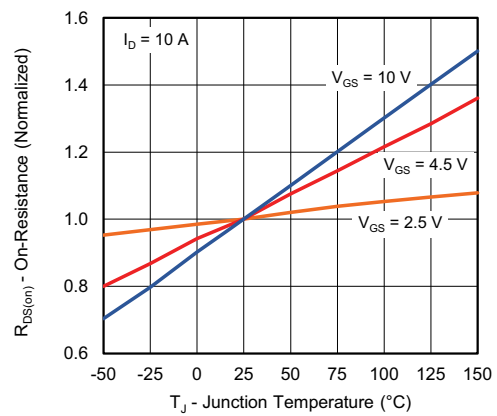
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



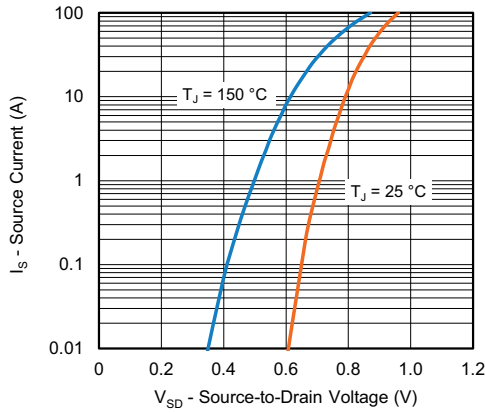
Gate Charge



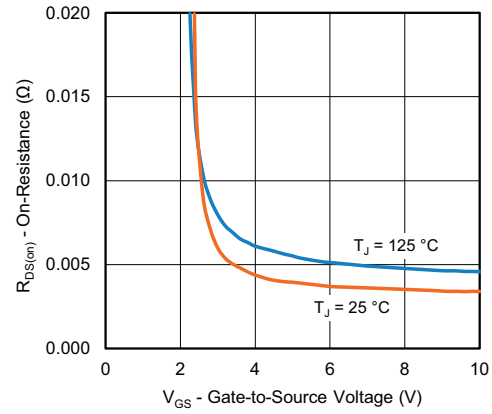
On-Resistance vs. Junction Temperature



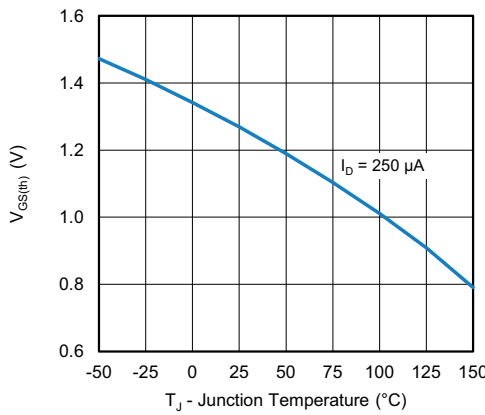
TYPICAL CHARACTERISTICS (T<sub>J</sub> = 25 °C, unless otherwise noted)



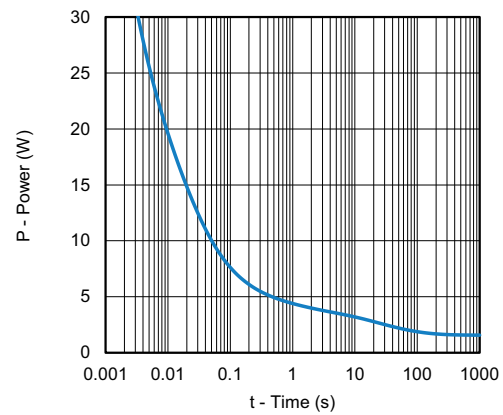
Source-Drain Diode Forward Voltage



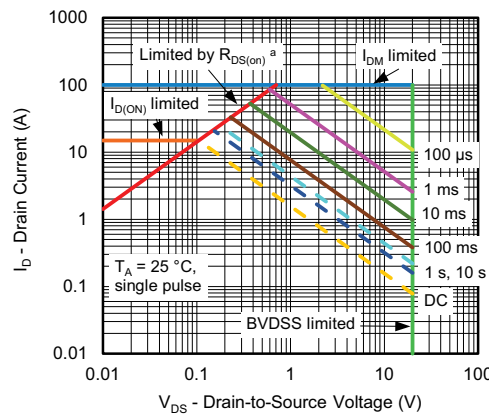
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power (Junction-to-Ambient)



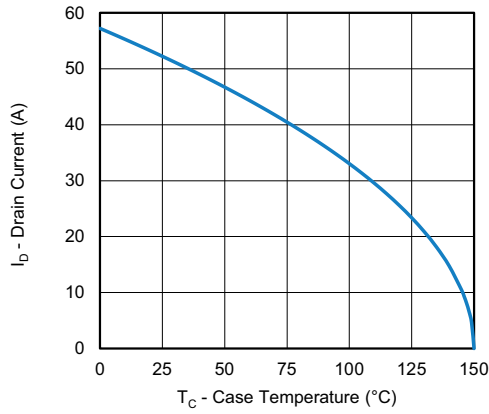
Safe Operating Area, Junction-to-Ambient

Note

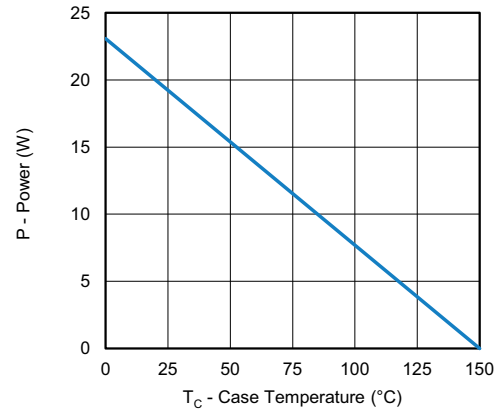
a. V<sub>GS</sub> > minimum V<sub>GS</sub> at which R<sub>DS(on)</sub> is specified



**TYPICAL CHARACTERISTICS** ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



**Current Derating<sup>a</sup>**



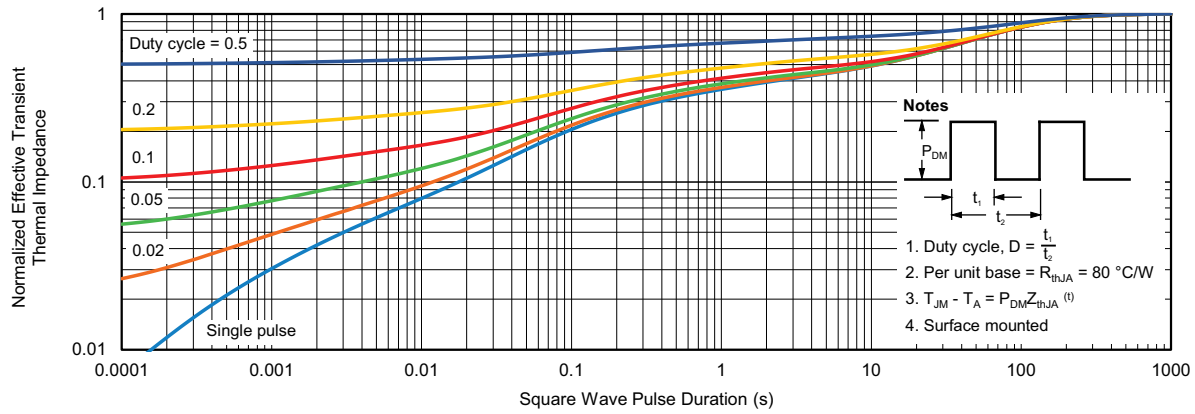
**Power Derating**

**Note**

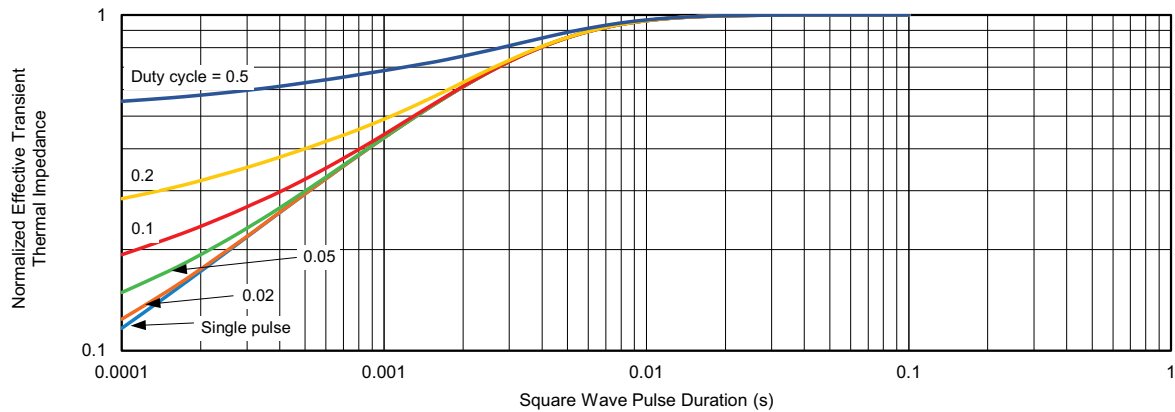
- a. The power dissipation  $P_D$  is based on  $T_J$  max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TYPICAL CHARACTERISTICS (T<sub>J</sub> = 25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package / tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?77122](http://www.vishay.com/ppg?77122).



PowerPAK® SC70-6L



BACKSIDE VIEW OF SINGLE



BACKSIDE VIEW OF DUAL



Notes:

1. All dimensions are in millimeters
2. Package outline exclusive of mold flash and metal burr
3. Package outline inclusive of plating

DIM	SINGLE PAD						DUAL PAD					
	MILLIMETERS			INCHES			MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A	0.675	0.75	0.80	0.027	0.030	0.032	0.675	0.75	0.80	0.027	0.030	0.032
A1	0	-	0.05	0	-	0.002	0	-	0.05	0	-	0.002
b	0.23	0.30	0.38	0.009	0.012	0.015	0.23	0.30	0.38	0.009	0.012	0.015
C	0.15	0.20	0.25	0.006	0.008	0.010	0.15	0.20	0.25	0.006	0.008	0.010
D	1.98	2.05	2.15	0.078	0.081	0.085	1.98	2.05	2.15	0.078	0.081	0.085
D1	0.85	0.95	1.05	0.033	0.037	0.041	0.513	0.613	0.713	0.020	0.024	0.028
D2	0.135	0.235	0.335	0.005	0.009	0.013						
E	1.98	2.05	2.15	0.078	0.081	0.085	1.98	2.05	2.15	0.078	0.081	0.085
E1	1.40	1.50	1.60	0.055	0.059	0.063	0.85	0.95	1.05	0.033	0.037	0.041
E2	0.345	0.395	0.445	0.014	0.016	0.018						
E3	0.425	0.475	0.525	0.017	0.019	0.021						
e	0.65 BSC			0.026 BSC			0.65 BSC			0.026 BSC		
K	0.275 TYP			0.011 TYP			0.275 TYP			0.011 TYP		
K1	0.400 TYP			0.016 TYP			0.320 TYP			0.013 TYP		
K2	0.240 TYP			0.009 TYP			0.252 TYP			0.010 TYP		
K3	0.225 TYP			0.009 TYP								
K4	0.355 TYP			0.014 TYP								
L	0.175	0.275	0.375	0.007	0.011	0.015	0.175	0.275	0.375	0.007	0.011	0.015
T							0.05	0.10	0.15	0.002	0.004	0.006

ECN: C-07431 – Rev. C, 06-Aug-07  
DWG: 5934

## RECOMMENDED PAD LAYOUT FOR PowerPAK® SC70-6L Single



Dimensions in mm/(Inches)

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